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STREPTOMYCIN INHIBITION OF ELABORATION OF STAPHYLOCOCCAL ENTEROTOXIC PROTEIN

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UNITED STATES ARMY
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STREPTOMYCIN INHIBITION OF ELABORATION OF STAPHYLOCOCCAL ENTEROTOXIC PROTEIN

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ABSTRACT

Staphylococcus aureus, strain S-6, under certain cultural conditions, synthesizes and elaborates into the medium an enterotoxic protein. We have observed that streptomycin interferes with the elaboration of this protein by streptomycin-resistant staphylococci at drug levels permitting continued synthesis of those proteins necessary for growth and multiplication of the organisms. It is likely that the enterotoxic protein is incomplete or that it is not released from the cell because of streptomycin-induced alterations in the cell itself.

STREPTOMYCIN INHIBITION OF ELABORATION OF STAPHYLOCOCCAL ENTEROTOXIC PROTEIN

Staphylococcus aureus, strain S-6, under certain cultural conditions, synthesizes and elaborates into the medium an enterotoxic protein.* We have observed that streptomycin interferes with the elaboration of this protein by streptomycin-resistant staphylococci at drug levels permitting continued synthesis of those proteins necessary for growth and multiplication of the organisms. Enterotoxin production in the streptomycin-dependent strain, even at the point of maximum population increase, was severely depressed.

Streptomycin sulfate (E.R. Squibb & Sons, New York) was added at various levels to a medium composed of N-Z-Amine, Type A (Sheffield Chem., Norwich, New York), 4.0%; yeast extract (Difco Laboratories, Detroit, Michigan), 0.4%; K_2HPO_4, 0.1%; and tap water, at pH 6.8 to 7.0. Twenty-five ml of this medium in a 250 ml Erlenmeyer flask was inoculated (1.0% vol/vol) with a culture of a phage-free isolate of Staphylococcus aureus, strain S-6. Isolates sensitive, resistant, and dependent, with regard to streptomycin, were used. The cultures were shaken (100 three-inch strokes/min) at 37 C for 24 hours after which optical density (1:10 dilution) and enterotoxin level were determined, the latter by the Oudin method.**

Figure 1 shows that enterotoxin level declined with optical density when the streptomycin-sensitive strain was treated with increasing concentration of streptomycin. Employing the resistant strain of the organism (Figure 2), enterotoxin level was decreased over a broad range of drug concentration in which there was no inhibition of culture growth. Although streptomycin at 250 to 1000 µg/ml was sufficient to allow normal culture growth of the streptomycin-dependent strain (Figure 3), the maximum detectable enterotoxic protein was less than 10% of that obtained with the sensitive or resistant strains and occurred at the lowest level of drug permitting normal culture growth.

These data show that streptomycin limits the elaboration of immunologically detectable enterotoxin in both resistant and dependent organisms under conditions in which they apparently are functioning normally in

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* Bergdoll, M.S.; Surgalla, M.J.; Dack, G.M. 1959. Staphylococcal enterotoxin. Identification of a specific precipitating antibody with enterotoxin-neutralizing property. J. Immunol. 83:334-338.

** Oudin, J. 1952. III. Techniques and analysis of the quantitative precipitin reaction. B. Specific precipitation in gels and its application to immunochemical analysis, p. 335-378, In A.C. Corcoran (ed.), Methods in Medical Research, Vol. 5. The Year Book Publishers, Inc., Chicago.

other respects. The reasons for this are not clear. Enterotoxin is not detectable until it reaches the cell surface.* Hypotheses based on the similarity of sites of protein synthesis and those of streptomycin action are tempting. The cell membrane would be of particular interest. It is unlikely under current concepts, that the protein suffers from miscoding. It is more likely that it is incomplete or that it is not released from the cell because of streptomycin-induced alterations in the cell itself.

* Friedman, M.E.; White, J.D. 1965. Immunofluorescent demonstration of cell-associated staphylococcal enterotoxin B. J. Bacteriol. 89:1155.

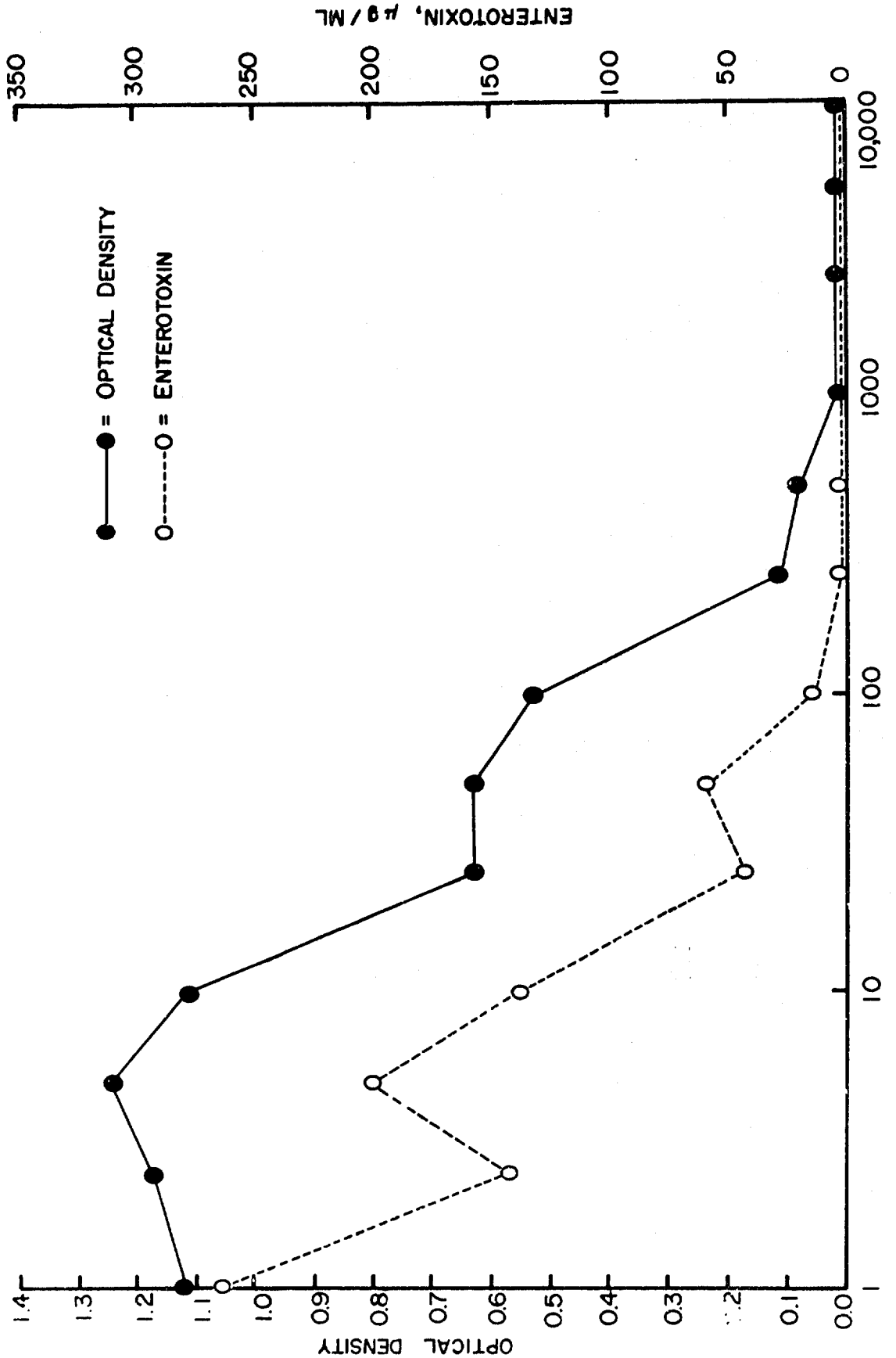

Figure 1. Growth and Synthesis of Enterotoxin by Streptomycin-Sensitive S. aureus in Presence of Streptomycin.

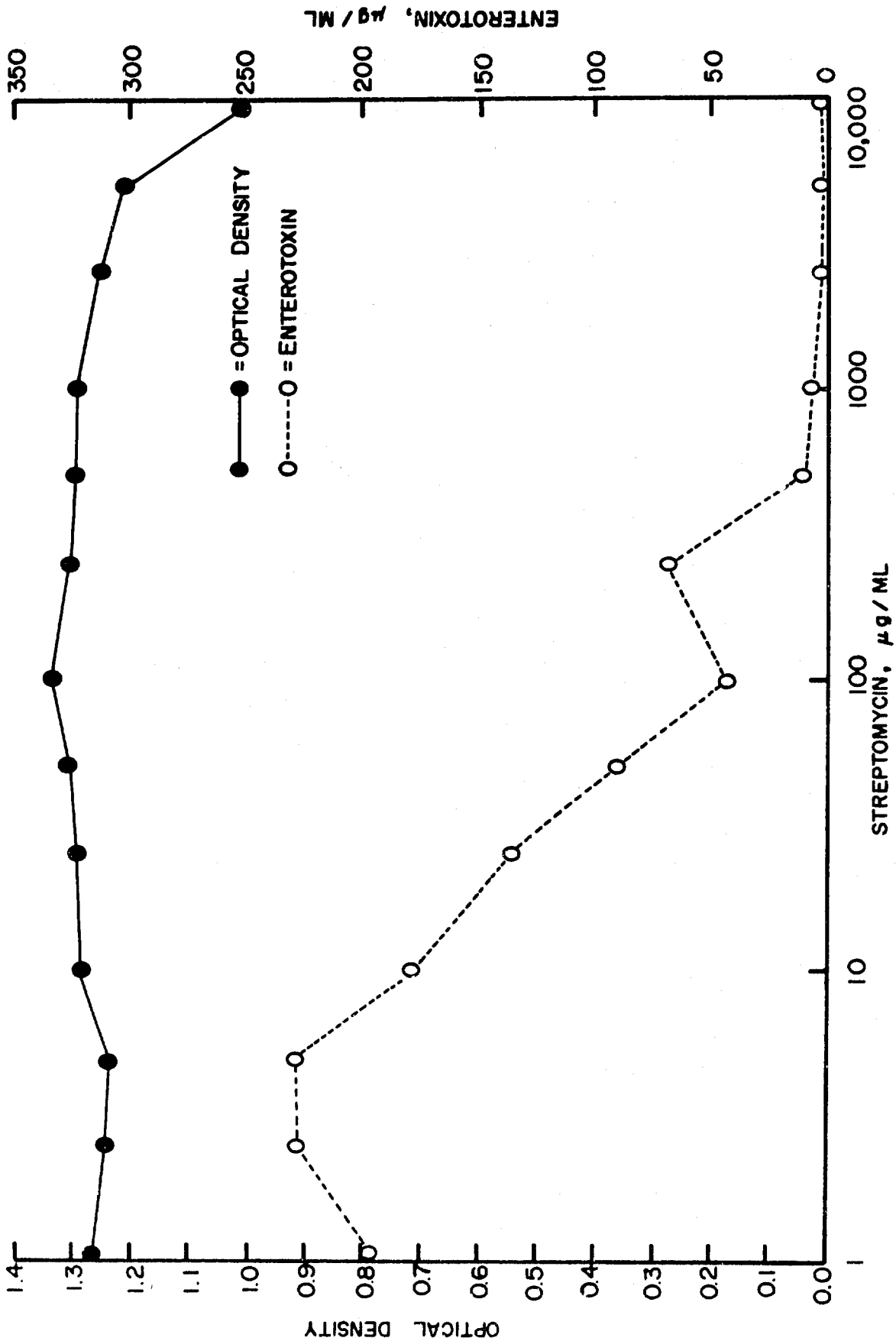

Figure 2. Growth and Synthesis of Enterotoxin by Streptomycin-Resistant S. aureus in Presence of Streptomycin.

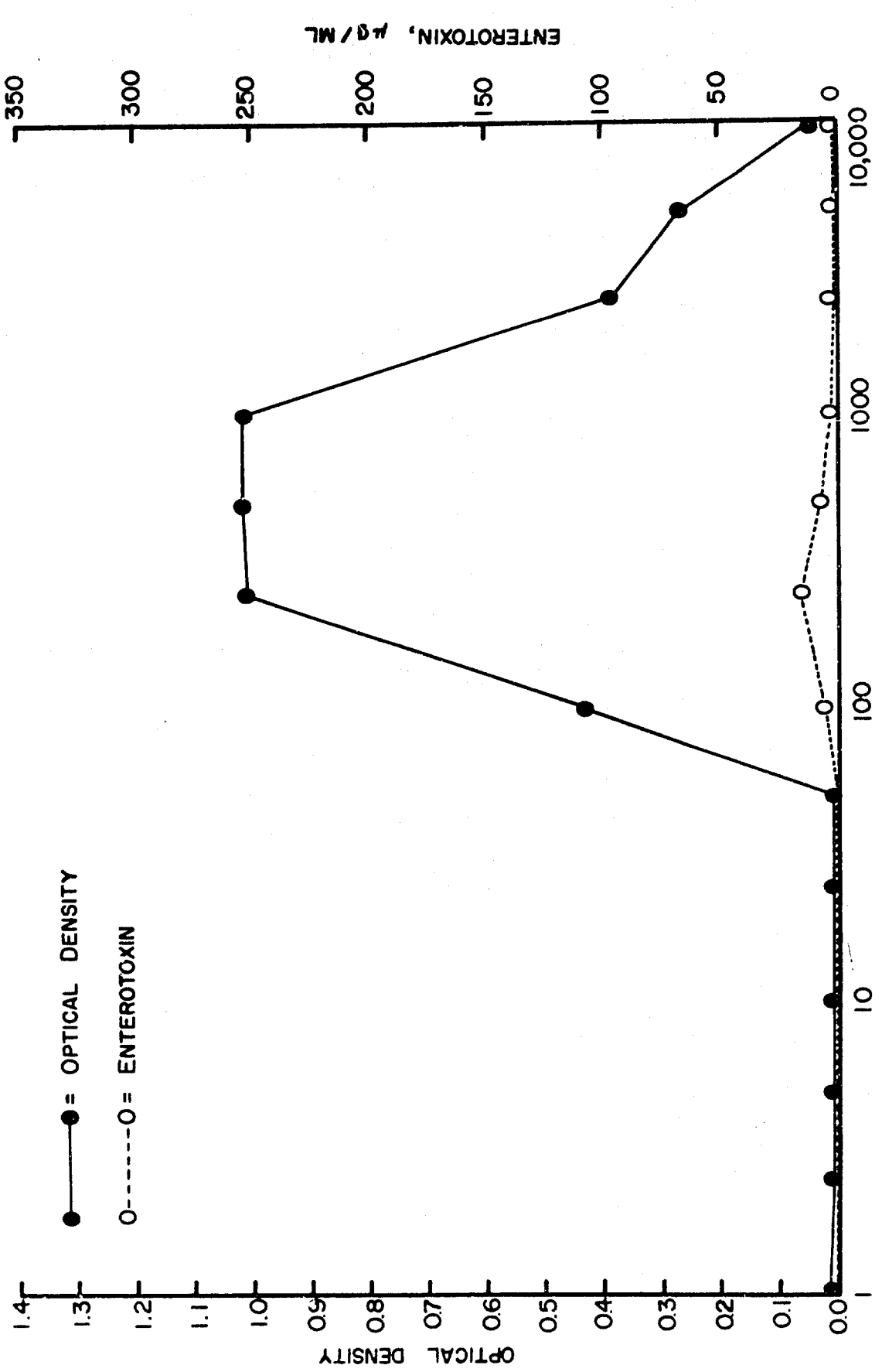

Figure 3. Growth and Synthesis of Enterotoxin by Streptomycin-Dependent S. aureus in Presence of Streptomycin.